

Developing ice detectors for wind turbines

Outlook of requirements and improvements
from 1990 till today

Winterwind 2014, Sundsvall, Sweden

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Content of the presentation

1. History and present status of Labkotec Ice Detectors (slides 3 - 5)
2. Testing and certification of ice detectors (slides 6 – 11)
3. Blade ice detection (slides 12 – 13)
4. Summary

Blade mounted ice detector 1994

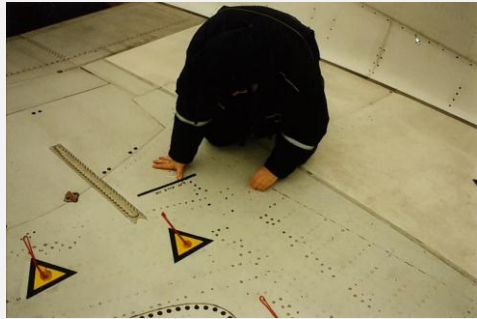
First ever blade mounted ice detector was delivered by Labko Oy (nowadays Labkotec) to Finland, Pyhätunturi, 1994.

→ Start blade heating



Figure BF. The first blade mounted ice detector delivered by Labko Oy. Pyhätunturi test station 1994.

Other ice detectors



Aeroplane
wing and
side of
cockpit
1994



Airports
2000 ->

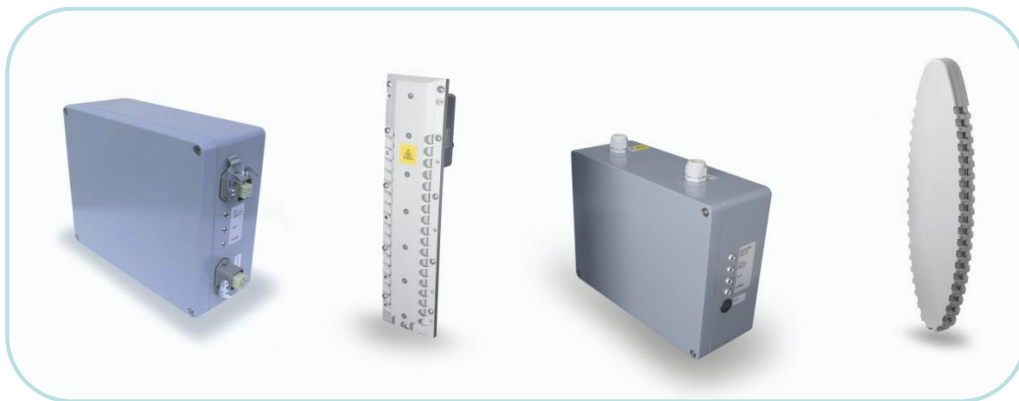


Milk
cooling
1990's



Met station 1990's

Labkotec ice detectors for wind turbines



	LID-3210C Control Unit and Ice Sensor	LID-3210D Control Unit with – Ice Alarm LED – Test button	LID/IS Ice Sensor – Sensitivity improved	LID-3300IP Control Unit – Web server (remote access) LID/ISD Ice Sensor – Sensitivity further improved
1994 ->	2002..2008	1Q/2008...2014	4Q/2008..2014	1Q/2010..

Testing and certification of ice detectors

Challenge:

No certifications rules, standards or published best practices exist for icing or ice detection tests.

Consequences:

In-house methods need to be used to verify and improve the functionality of an ice detector.

Such methods are not always recognized and accepted by authorities and wind farm developers.

Testing - freezing rain (2008) (1/2)

Test method:

Icing/Freezing rain, MIL-STD-810F, Method 521.2

Summary:

The Ice Detector LID/IS recognized the newly formed thin layer of ice at the preset signal amplitude on all three repetitions of the test and switched on the deicing of the detector at the preset lower signal amplitude.



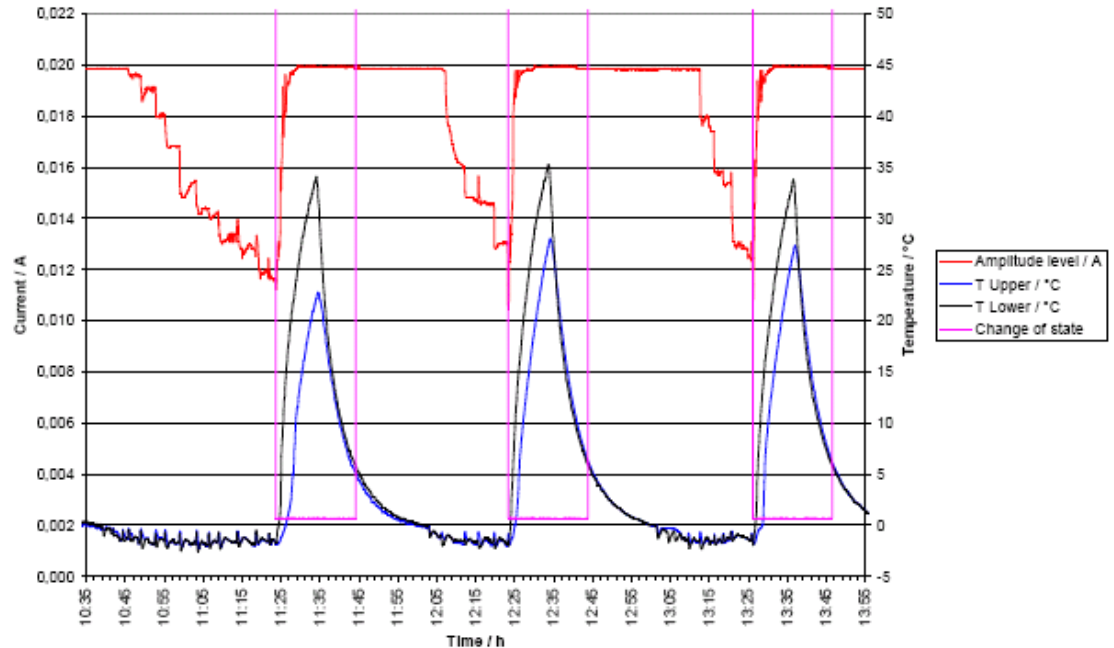
Testing - freezing rain (2008) (2/2)

Test method:

Icing/Freezing rain,
MIL-STD-810F,
Method 521.2

Summary:

(see previous slide)



CFD modelling (2010/2011)

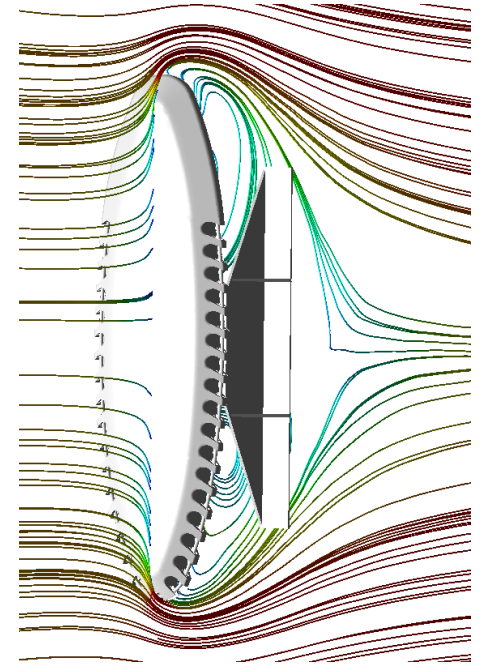
Test method:

Simulating the flow of ice particles of different size and velocity around LID/ISD ice sensor with CFD (Computational Fluid Dynamics) method.

Summary:

Shape of the sensor was changed to direct and increase the velocity of ice particles around the sensing wire.

→ Good correlation to the actual speed of blade.



Testing - in-cloud icing (2011)

Test methods:

In-house methods by VTT to evaluate instrumental icing in standard icing conditions.

Simulations with 44 meter wind turbine blade.

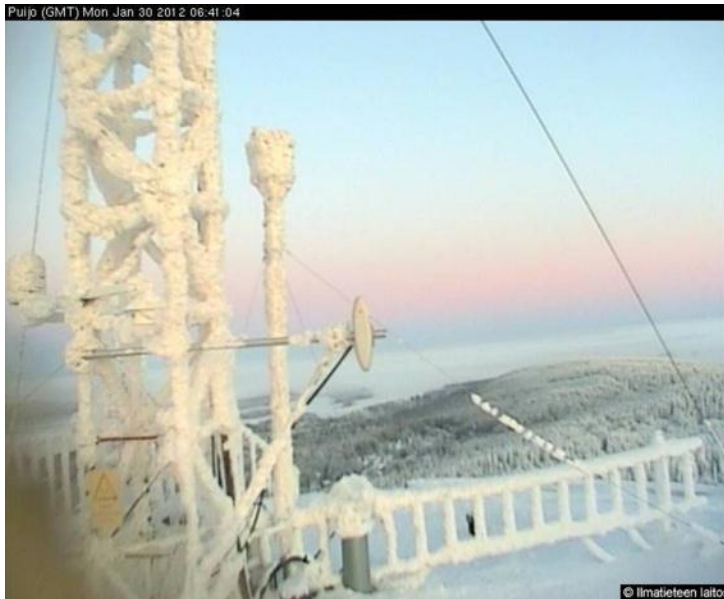
Summary:

LID-3300IP ice detector is applicable for wind turbines and meteorological weather stations.

Device is capable for detecting in-cloud icing and freezing rain.



Field tests

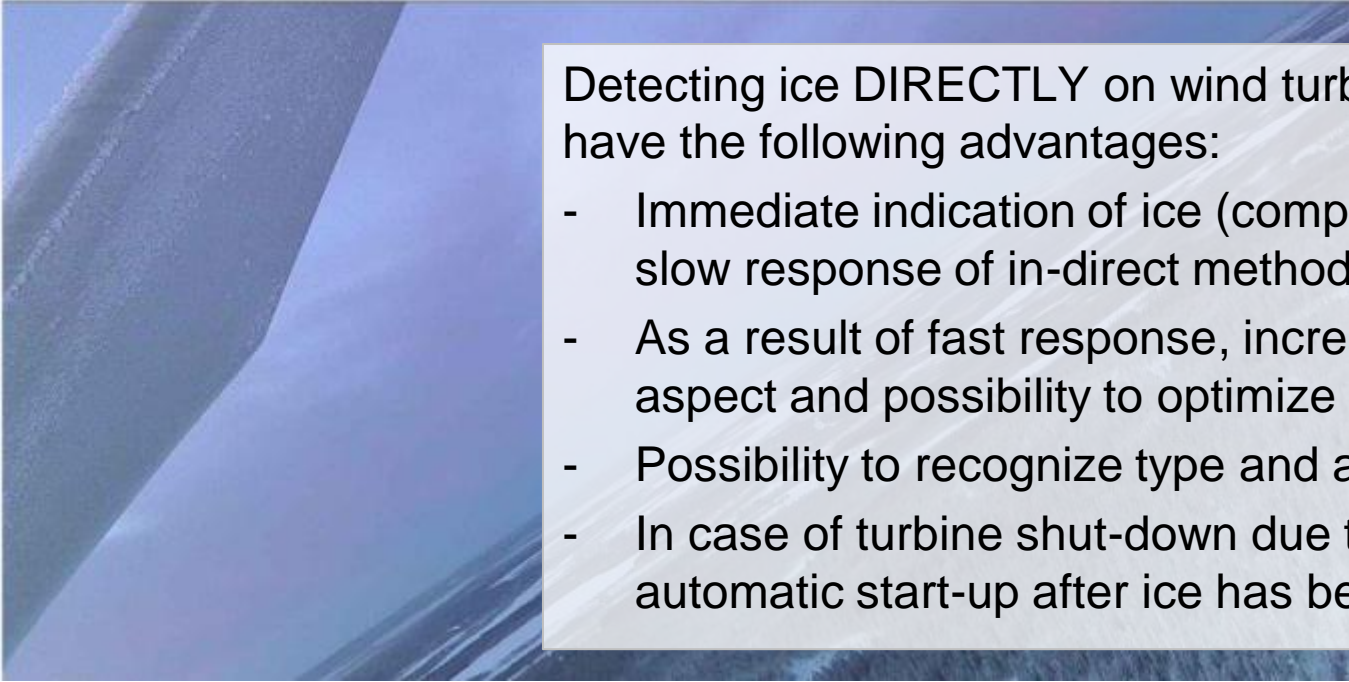


Puijo MET station, Finland 2009-2014



Wind turbines (data often confidential)

Blade ice detector - advantages



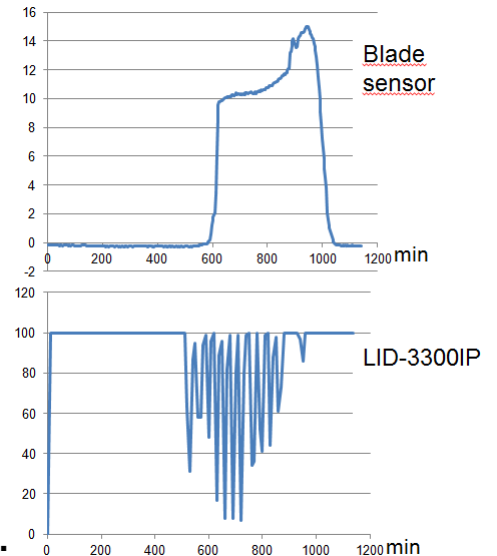
Detecting ice DIRECTLY on wind turbine blade will have the following advantages:

- Immediate indication of ice (compared to rather slow response of in-direct methods)
- As a result of fast response, increased safety aspect and possibility to optimize blade heating
- Possibility to recognize type and amount of ice
- In case of turbine shut-down due to ice, automatic start-up after ice has been removed

Labkotec blade ice detector

- Labkotec is developing an ice detector for wind turbine blade
- Tests have been ongoing since 2011 in
 - In-house icing laboratory
 - Weather chamber
 - Icing wind tunnel
 - Met station
 - Wind turbine
- More information available later this year !

Got interested? Please contact: jarkko.latonen@labkotec.fi.



Summary

- Labkotec is a pioneer and market leader in wind turbine ice detection.
- Labkotec has and will introduce new innovations for ice detection regardless of the fact that no certifications rules, standards or published best practices exist for icing or ice detection tests.
- Labkotec will develop an ice detector to detect ice directly on wind turbine blades.

2014
50
1964

Labkotec